OPERATING INSTRUCTIONS

TYPE 1215-B

UNIT OSCILLATOR

GENERAL RADIO COMPANY

794-D

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UNIT OSCILLATOR

Form 794-D
July, 1960

GENERAL RADIO COMPANY
WEST CONCORD, MASSACHUSETTS, USA

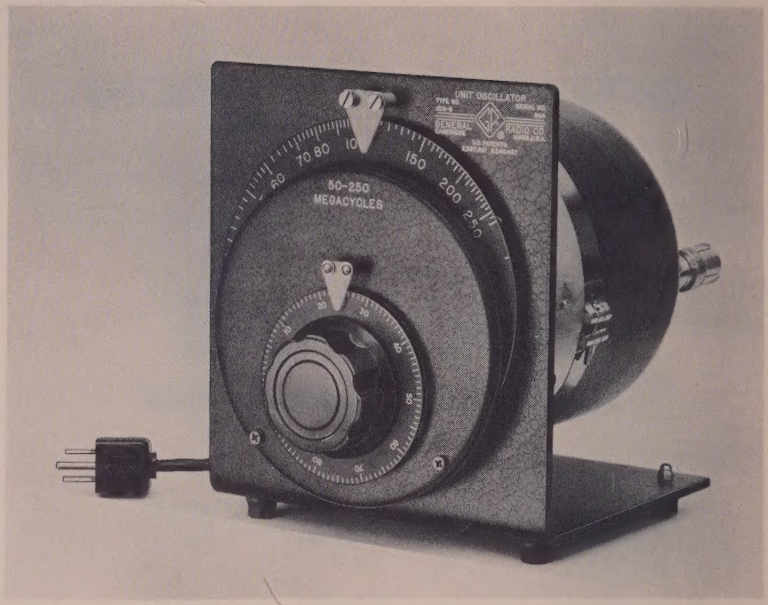


Figure 1. Type 1215-B Unit Oscillator

SPECIFICATIONS

Frequency Range:	50-250 Mc.
Tuned Circuit:	Semi-butterfly. No sliding contacts.
Frequency Control:	6-in. dial with direct calibration over 150 deg.
Frequency Calibration Accuracy:	1% at no load.
Warm-up Frequency Drift:	0.3% (see Figure 3).
Output System:	Short coaxial line with coupling loop at one end and Type 874 Coaxial Connector at other end. Maximum power can be delivered to load impedances normally encountered in coaxial systems.
Output Power:	At least 80 mw into a 50-ohm load (see Figure 2).
Power Requirements:	370 v dc at 25 ma 6.3 v ac or dc at 0.3 amp.
Modulation:	Plate modulation at audio frequencies can be produced by an external source. For 30% modulation, 40 volts is required. Input impedance is about 15,000 ohms. Type 1000-P6 Crystal Diode Modulator and Type 1000-P7 Balanced Modulator are recommended to avoid incidental fm. Refer to Table in paragraph 1.3.3, page 3.
Oscillator Tube:	Type 12AT7 miniature twin triode, supplied with instrument.
Mounting:	Oscillator is mounted on an aluminum casting, and is shielded with spun-aluminum cover. Assembly is mounted on an L-shaped panel and chassis.
Accessories Supplied:	Type CDMA Phone Plug, Type 874-R22 Patch Cord, Type 874-C Cable Connector, Type 874-P Panel Connector, and Type CDMS-18-4 Multipoint Connector.
Accessories Available:	Refer to Table in paragraph 1.3.3, page 3.
Dimensions:	Width 7 in., height 8 in., depth 9½ in. (180 by 205 by 245 mm), over-all.
Weight:	7½ lb (3.4 kg).

U. S. Patent Nos. 2,367,681 and 2,548,457.

General Radio Experimenter reference: Vol XXIX No. 11, April, 1955.

TYPE 1215-B
UNIT OSCILLATOR

Section 1
INTRODUCTION

1.1 PURPOSE. The Type 1215-B Unit Oscillator (Figure 1) is a general-purpose radio-frequency oscillator, covering the range of 50 to 250 Mc. It can be used to drive bridges, admittance meters, impedance meters, impedance comparators, and other such equipment. Used with a voltmeter and attenuator it provides an accurately known output voltage for receiver testing. Direct amplitude modulation is possible over the audio-frequency range, and amplitude modulation free from incidental fm can be obtained from 0 to 5 Mc with a simple crystal diode modulator such as the General Radio Type 1000-P6. Connected to a mixer such as the Type 874-MR, the Unit Oscillator can be used as the local oscillator of a heterodyne receiver to convert a low-frequency communications receiver into a detector for vhf signals. Pulsing and linear 100-percent amplitude modulation can be obtained with an external balanced modulator.

1.2 DESCRIPTION. The oscillator unit is mounted on a cylindrical casting which encloses the filter components. All leads are carefully filtered to keep the external field to a low value. A cylindrical cover is held in place by a metallic strap for complete shielding. The output mechanism (loop and coaxial connector) is mounted on this cover.

The tuning system is a modified "butterfly" arrangement, in which the plates are shaped to permit operation over 150 degrees rotation. There are no sliding contacts in the tuned circuit. The triode sections of the oscillator tube (miniature twin-triode Type 12AT7) are connected in push-pull across the high-impedance portions of the tuned circuit.

1.3 ACCESSORIES.

1.3.1 AMPLITUDE MODULATION. An audio oscillator can be connected in the cathode circuit of the Unit Oscillator to give direct amplitude modulation over the audio-frequency range. The audio oscillator circuit must supply a d-c path and be able to carry 25 ma dc.

Direct cathode modulation of the oscillator introduces some incidental frequency modulation. Amplitude modulation free from incidental fm can be obtained by means of a Type 1000-P6 Crystal Diode Modulator and a Type 1000-P7 Balanced Modulator.

1.3.2 SWEEP AND DIAL DRIVES. The frequency dial of the Type 1215-B Unit Oscillator can be mechanically swept back and forth by the Type 1750-A Sweep Drive, the Type 908-P Synchronous Dial Drive, or the Type 908-R X-Y Dial Drive.

The Sweep Drive can be coupled either to the slow-motion dial or to the main frequency dial of the Unit Oscillator. When the main frequency dial is coupled to the Sweep Drive, the sweep rate should be restricted to one excursion per second or less. The slow-motion dial can be driven at rates up to 5 cycles per second. The magnitude and center position of the sweep arc, as well as the sweep rate, can be set by controls on the Sweep Drive panel. The Sweep Drive also provides horizontal deflection voltage, proportional to shaft rotation, for an oscilloscope. A blanking contactor eliminates the return trace.

The Type 908-P Synchronous Dial Drive is useful with graphic recorders that are running at constant speed. The Type 908-R X-Y Dial Drive produces a sweep voltage proportional to shaft rotation to drive the independent variable axis of an x-y plotter or of an oscilloscope.

The combination of a Type 1215-B Unit Oscillator, Sweep or Dial Drive, and Type 1263-A Amplitude-Regulating Power Supply is a versatile sweep generator for recording or oscilloscopic display of frequency characteristics.

When the Type 1215-B Unit Oscillator is driven by a sweep or dial drive, all moving parts in the oscillator must be lubricated in accordance with paragraph 4.3.

1.3.3 OTHER ACCESSORIES. Supplied with the Unit Oscillator are a Type 874-R22 three-foot coaxial double-shielded Patch Cord, a Type 874-PB Panel Connector, and a Type 874-C Cable Connector to facilitate complete coaxial connections to the equipment under test.

The table on page 3 lists accessories recommended for use with the Type 1215-B Unit Oscillator.

TABLE OF ACCESSORIES

Accessory and Function	Instrument	Remarks
POWER SUPPLIES		
Standard	Type 1203-B Unit Power Supply	115-v, 50-60-cps line
Stabilized Plate Voltage	Type 1201-A Unit Regulated Power Supply	105-125-v, 50-60-cps line (reduced output)
Adjustable Plate Voltage	Type 1204-B Unit Variable Power Supply	115-v, 60-cps line
Adjustable Regulated Plate Voltage	Type 1205-B Adjustable Regulated Power Supply	105-125 v, 60-cps line
Constant Output Level vs Frequency	Type 1263-A Amplitude Regulating Power Supply with Type 874-VR Voltmeter Rectifier, Type 874-Q6 Adaptor, and Type 274-NF Patch Cord	115- or 230-v, 50-60-cps line (reduced output)
MODULATORS		
Plate Modulation	Type 1214-A Unit Oscillator	400 and 1000 cps output, 115-v, 40-60-cps line
Square-Wave or Pulse Modulation	Type 1219-A Unit Pulse Amplifier	Requires modulation source.
Absorption Modulation with no Incidental Fm	Type 1000-P6 Crystal-Diode Modulator	Requires modulation source. Modulation freq range 0-5 Mc. Maximum output 10 mv.
Balanced Modulation for linear 100-percent amplitude modulation and for pulses with high degree of carrier suppression	Type 1000-P7 Balanced Modulator	Requires modulation source. Modulation frequency range 0-20 Mc.
SWEEP DRIVE		
Automatic Frequency Sweep	Type 1750-A Sweep Drive Type 908-P Synchronous Dial Drive Type 907-R Dial Drive	Type 1263-A Amplitude-Regulating Power Supply recommended to keep oscillator output level constant.
RELAY RACK PANEL	Type 480-P5UC1	For Types 1203-B and 1215-B or for 1201-B and 1215-B
ADAPTORS - available for connecting Type 874 coaxial output terminals to other coaxial systems. See Table at rear of manual.		

Section 2
OPERATING PROCEDURE

2.1 INSTALLATION. The Type 1215-B Unit Oscillator is shipped complete with tube installed, and is ready for use when connected to a suitable power supply. A cord and connector are supplied with the instrument for direct connection to a General Radio Unit Power Supply. Connect the oscillator to the equipment under test by means of the three-foot cable supplied. If necessary, install one of the two connectors supplied on the equipment under test, or use one of the many adaptors available for the various coaxial systems (see Table at rear of manual).

If a power supply other than a General Radio Unit Power Supply is used, it should be able to supply 370 volts dc at 25 milliamperes and 6.3 volts ac at 0.3 ampere. To reduce these requirements, two 2.4-kilohm resistors (R5, R6) can be removed. The leakage will then be greater, and care must be taken not to exceed the maximum allowable plate dissipation of the oscillator tube, which is rated at 5 watts.

2.2 OPERATION. After turning on the power supply, adjust the frequency by means of the frequency dial, and adjust the output by rotating the output coupling loop. For low output the coupling loop can be partly withdrawn. Typical output characteristics are shown in Figure 2.

The frequency of the oscillator varies for some time after the power has been applied, until the temperature has stabilized. This warmup drift is usually well under -0.25%. It depends upon frequency and varies considerably from one oscillator to the other. A representative curve is shown in Figure 3.

For amplitude modulation the audio modulating voltage should be applied at the modulation jack. Full plate current must flow through the modulating source. A modulating voltage of about 40 volts is required for 30-percent modulation. The input impedance is about 15,000 ohms.

2.3 FREQUENCY DEVIATION. For some applications a well-regulated and filtered power supply should be used to avoid frequency variations caused by line-voltage fluctuation and to produce a clearer beat note at the highest frequencies. With an unregulated power supply, a line-voltage variation of 20 percent causes a frequency change of about 0.01 percent below 200 Mc, increasing to about 0.03 percent at 250 Mc.

As mentioned above, amplitude modulation over the audio range can be obtained by an audio-frequency voltage superimposed on the dc power supply. Incidental fm, inherent in this system, is under 0.01% up to 100 Mc and under 0.05% at 250 Mc, for 50% amplitude modulation.

2.4 SQUARE-WAVE AND PULSE MODULATION. The rise time of the Type 1209-B Unit Oscillator depends upon frequency and load conditions, and is never adequate to reproduce short pulses faithfully. However, modulation with square waves and long pulses might be desirable for applications where incidental frequency modulation must be kept to a minimum.

For best results, the plate power supply should be disconnected. Then ground the junction of R8, C5, and R5 and introduce square waves or pulses at the modulation jack. With 150 volts at 20 to 30 ma, either pulses or square waves, output will be the same as that obtainable with a Unit Power Supply. A Type 1219-A Unit Pulse Amplifier driven by a Type 1210-C Unit R-C Oscillator for square waves or by a Type 1217-A Unit Pulser would be suitable for this purpose.

Figure 2. Typical Output Characteristic

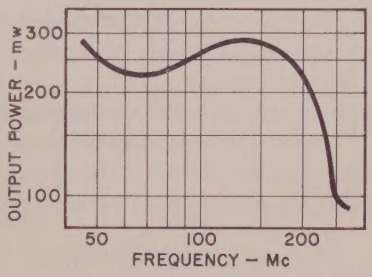
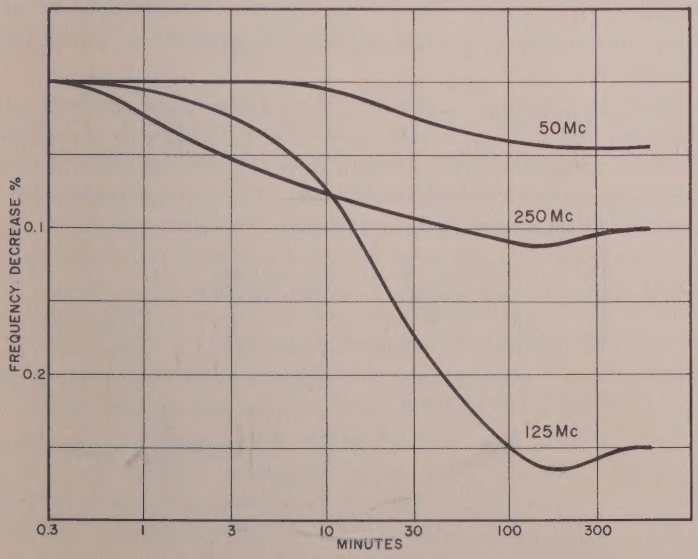


Figure 3. Typical Warm-Up Drift Characteristic



Section 3
APPLICATIONS

3.1 GENERAL. The utility and versatility of the Type 1215-B Unit Oscillator are greatly increased by the large selection of Type 874 Coaxial Elements available from General Radio Company. These elements are part of a complete, integrated line of equipment for the measurement of voltage, power, and standing-wave ratio at very high and ultra high frequencies. Although the Unit Oscillator is intended primarily as a source of power for this measuring equipment and for other impedance-measuring devices such as the Type 1602-A UHF Admittance Meter, use of the coaxial elements can adapt the Unit Oscillator to various applications in the radio-frequency laboratory in place of more expensive equipment that is not always available. The tuning circuit of the Type 1215-B can be motor-driven for sweep applications by a sweep or dial drive (refer to paragraph 1.3.2).

Three applications are described in the following paragraphs. Others will be suggested by a study of the complete list of General Radio Type 874 Coaxial Elements, included in the General Radio Catalog.

3.2 UNIT OSCILLATOR AS A SIGNAL GENERATOR FOR RECEIVER TESTING. The Unit Oscillator, as a well-shielded power source, can be used as a signal generator for receiver testing if means are provided to measure and attenuate the output. A recommended arrangement of accessories is shown in Figure 4.

For complete coverage of the 50-250-Mc range, four sections of Type 874-L20 Air Line and a 20-$\mu\mu$f fixed capacitor (C, Figure 4) series-mounted in a Type 874-X Insertion Unit are required. With these units the oscillator output can be tuned for maximum current in the center conductor of the attenuator to which the output loop is coupled.

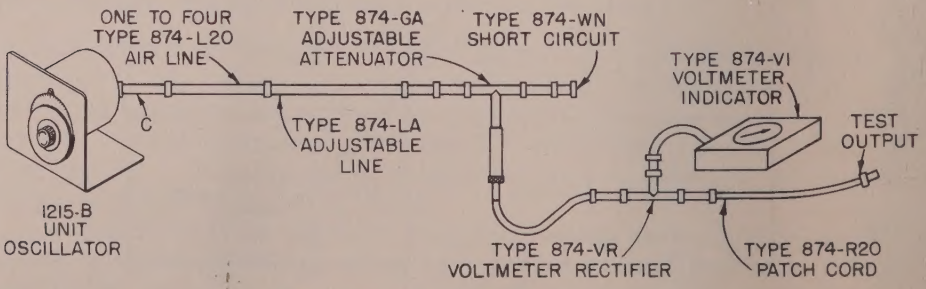


Figure 4. Connection Diagram,
Unit Oscillator Used as Standard-Signal Generator

The attenuator is calibrated in decibels. At minimum attenuation the attenuator output is measured by a crystal diode in the Type 874-VR Voltmeter Rectifier and read on the meter of the Type 874-VI Voltmeter Indicator. Means are provided to standardize the crystal indication. A 50-ohm resistor following the crystal determines the output impedance.

This arrangement is similar to that used in the Type 1021-A Standard-Signal Generator. The attenuator calibration covers 150 db, but the shielding of the Unit Oscillator and various other components is not sufficient to make accurate measurements in the microvolt region.

3.3 UNIT OSCILLATOR AS TELEVISION SIGNAL GENERATOR. Used in combination with a Type 1000-P6 Crystal-Diode Modulator and a Type 874-G20 20-db Fixed Attenuator, the Unit Oscillator is a convenient source of television signals over its entire carrier-frequency range if video modulating voltage is available. The arrangement of components is shown in Figure 5. The required modulating voltage can be furnished by a standard television receiver tuned to a local station.

Since the modulator is separated from the oscillator by an attenuator pad, amplitude modulation will be free from incidental fm.

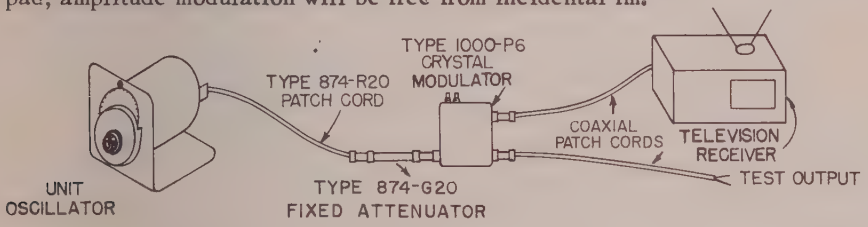


Figure 5.
Connection Diagram, Unit Oscillator Used as Television Signal Generator

3.4 UNIT OSCILLATOR AS FREQUENCY CONVERTER. Connected to the Type 874-MR Mixer Rectifier, the Unit Oscillator can provide the local signal in a heterodyne converter, and thus adapt the Type 1216-A I-F Amplifier or a low-frequency communications receiver for use as a sensitive detector for vhf signals. The setup is shown in Figure 6. The Type 1216-A I-F Amplifier has a built-in precision attenuator and a panel meter. Its bandwidth is 0.7 Mc and it has excellent sensitivity. Provision is made for measurement of the rectified mixer current in the i-f amplifier, and a separate built-in power supply is available for operating the Unit Oscillator.

For the uhf range of 250 to 920 Mc, the Type 1209-B Unit Oscillator is an excellent companion instrument to the Type 1215-B. The two oscillators are similar in appearance and construction.

3.5 PULSE MODULATION. At carrier frequencies above 60 Mc the Type 1000-P7 Balanced Modulator is very useful for modulating the Unit Oscillator, since it has the fast rise-time characteristic and high carrier suppression

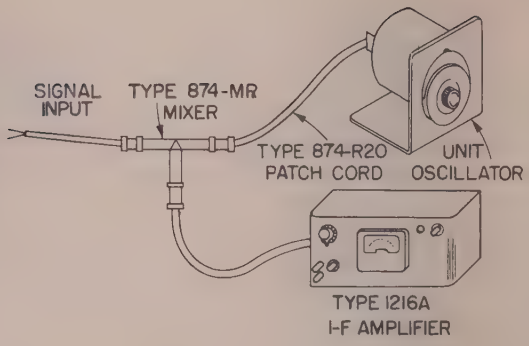


Figure 6. Connection Diagram, Unit Oscillator and Mixer Rectifier Used as Frequency Converter

necessary for pulse modulation with a pulse source such as the Type 1217-A Unit Pulser. Linear amplitude modulation up to 100 percent is also possible over a modulating frequency range of 0 to 20 Mc, with low incidental fm.

Section 4
SERVICE and MAINTENANCE

4.1 GENERAL. The two-year warranty given with every General Radio instrument attests the quality of materials and workmanship in our products. When difficulties do occur, our service engineers will assist in any way possible.

In case of difficulties that cannot be eliminated by the use of these service instructions, please write or phone our Service Department, giving full information of the trouble and of steps taken to remedy it. Be sure to mention the serial and type numbers of the instrument.

Before returning an instrument to General Radio for service, please write to our Service Department or nearest district office (see back cover), requesting a Returned Material Tag. Use of this tag will insure proper handling and identification. For instruments not covered by the warranty, a purchase order should be forwarded to avoid unnecessary delay.

4.2 FREQUENCY CALIBRATION. Tube replacement will generally cause less than a 0.5-percent change in frequency. If a source of standardizing frequencies is available, the trimmer capacitor (a small, slotted rectangular plate; C1, Figure 8) can be readjusted for correct calibration at the 250-Mc end of the range. The shield cover must be in place when the frequency is measured.

4.3 LUBRICATION. When the Type 1215-B Unit Oscillator is driven by a sweep or dial drive, all moving parts must be properly lubricated. Proper lubrication includes an occasional drop of light oil at the ball bearings, and occasional relubrication of the pinion gear in the dial assembly.

PARTS LIST

	REF DES	DESCRIPTION	GR NO. (NOTE A)
RESISTORS (NOTE B)	R1	5.1k ±5%, ½w	REC-20BF
	R2	10 ±5%, ½w	REC-20BF
	R3	10 ±5%, ½w	REC-20BF
	R4	5.1k ±5%, ½w	REC-20BF
	R5	2.4k ±5%, 2w	REC-41BF
	R6	2.4k ±5%, 2w	REC-41BF
	R7	1k ±10%, 1w	REC-30BF
	R8	1k ±10%, 1w	REC-30BF
CAPACITORS (NOTE C)	C1	Built-in air trimmer	
	C2	4.7 ±0.5μμf	CC20CG479D*
	C3	4.7 ±0.5μμf	CC20CG479D*
	C4	1000 ±20% max neg	GP,CN-1
	C5	500	COU-8-2
	C6	500	COU-24
	C7	2000	COU-10-2
	C8	1000	COU-24
	C9	500	COU-8-2
	C10	500	COU-24
	J1	JACK, Signal	CDSJ-10
	L1	CHOKE, 20μh	ZCHA-29
	L2	LOOP, R-f pickup	874-402-2
	LC1	BUTTERFLY, 50-250 Mc	Built in
	PL1	PLUG	1215-33
	V1	TUBE, Type 12AT7	

NOTES:

(A) REC=Composition resistor.

(B) All resistances in ohms except as otherwise indicated by k (kilohms).

(C) All capacitances in μμf.

* Electrical Reactance Corp part no.

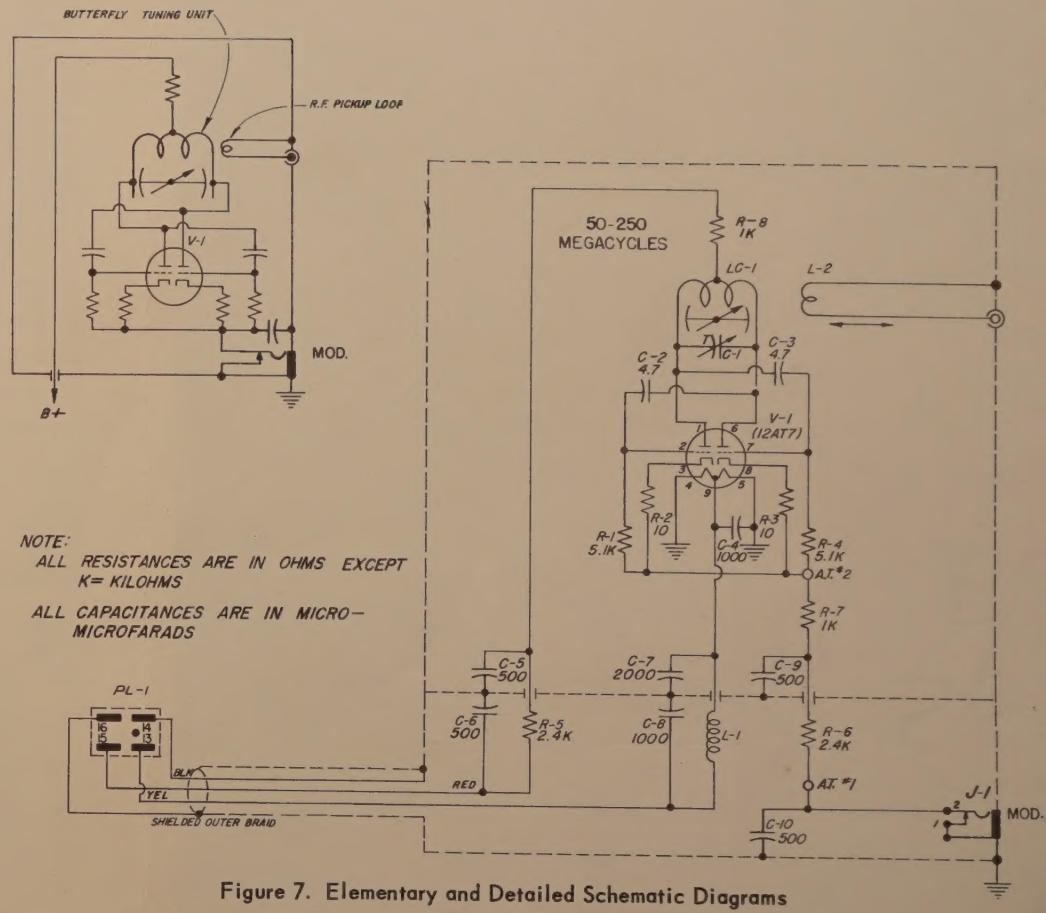


Figure 7. Elementary and Detailed Schematic Diagrams

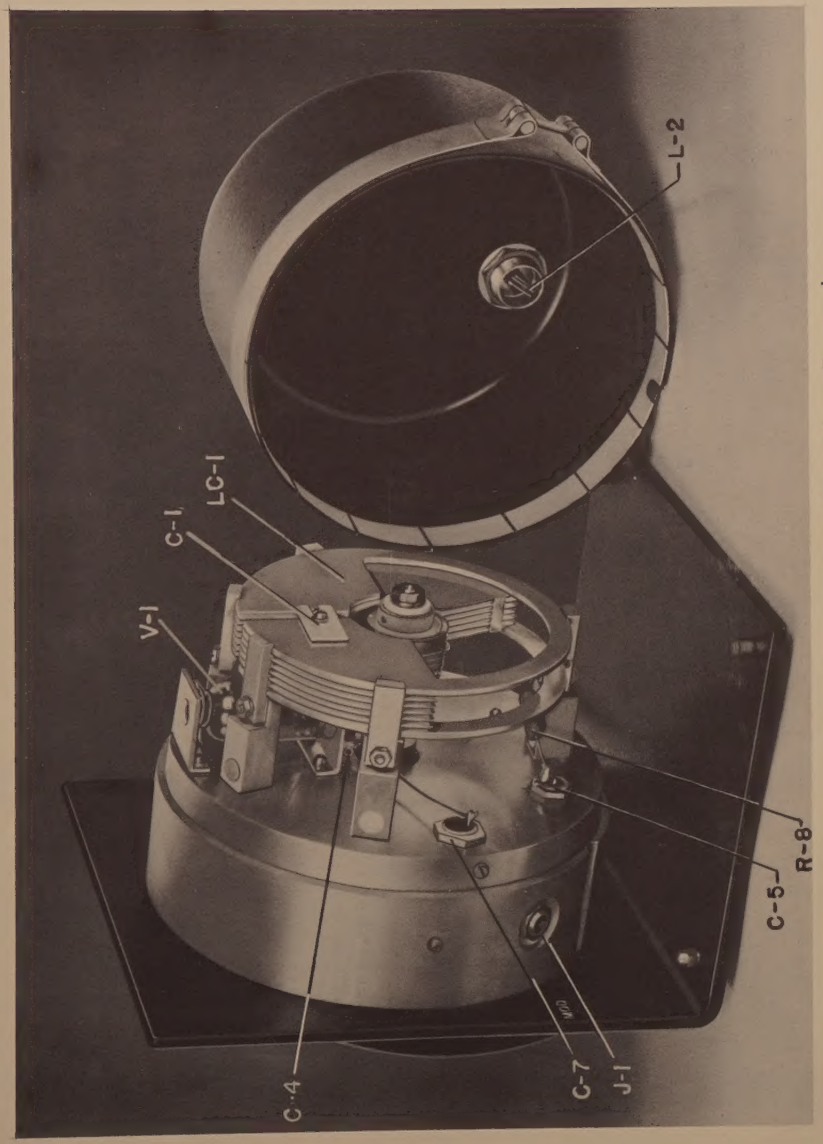


Figure 8. Type 1215-B Unit Oscillator, Cover Removed

TYPE 874 ACCESSORIES

ADAPTORS

Type	Contains Type 874 Connector and	Fits
874-QBJ	BNC Jack	BNC Plug
874-QBP	BNC Plug	BNC Jack
874-QCJ	C Jack	C Plug
874-QCP	C Plug	C Jack
874-QHJ	HN Jack	HN Plug
874-QHP	HN Plug	HN Jack
874-QLJ	LC Jack	LC Plug
874-QLP	LC Plug	LC Jack
874-QLTJ	LT Jack	LT Plug
874-QLTP	LT Plug	LT Jack
874-QNJ	N Jack	N Plug
874-QNP	N Plug	N Jack
874-QSCJ	SC Jack	SC Plug
874-QSCP	SC Plug	SC Jack
874-QTNJ	TNC Jack	TNC Plug
874-QTNP	TNC Plug	TNC Jack
874-QUJ	UHF Jack	UHF Plug
874-QUP	UHF Plug	UHF Jack
874-QU1A		7/8" 50Ω UHF rigid air line
874-QU2		1-5/8" 50Ω UHF rigid air line
874-QU3A		3-1/8" 50Ω UHF rigid air line
874-QV2A		1-5/8" 51.5Ω VHF rigid air line
874-QV3		3-1/8" 51.5Ω VHF rigid air line
874-Q2	274 Jack	274 Plug
874-QN6	Pin & Sleeve	274-NO
874-Q7	774 Jack	774 Plug
874-Q9	274 Plug	binding-post pair

CABLE (DOUBLE-SHIELDED)

Type	Z	Attenuation/100 ft
874-A2	50Ω ±5%	2.6 db at 100 Mc
874-A3	50Ω ±5%	5.3 db at 100 Mc

CONNECTORS

CABLE CONNECTORS TYPE	FOR CABLE TYPE
874-C	874-A2
874-C8	RG8/U
874-C9	RG9/U, RG116/U
874-C58	874-A3, RG29/U, RG55/U, RG58/U, RG58A/U
874-C62	RG59/U, RG62/U
PANEL CONNECTORS (-P -HEX NUT MTG, -PB -FLANGE MTG)	
874-P, -PB	874-A2
874-P8, -PB8	RG8/U
874-P9, -PB9	RG9/U, RG116/U
874-P58, -PB58	874-A3, RG29/U, RG55/U, RG58/U, RG58A/U
874-P62, -PB62	RG59/U, RG62/U

PATCH CORDS (3 FT)

TYPE	CONNECTOR	CABLE	CONNECTOR
874-R20	874-C	874-A2	874-C
874-R22	874-C58	874-A3	874-C58
874-R33	874-C58	Single-shielded	274-P
874-R34	874-C58	Single-shielded	274-NK

MISCELLANEOUS

TYPE 874-		TYPE 874-		TYPE 874-	
BM	300Ω Balanced Termination	LK	Constant-Z Adjust. Line	UB-P3	300Ω Balun Terminal Pad
D	Adjustable Stubs	LR	Radiating Line	VC	Variable Capacitor
EL	90° Ell	LT	Trombone-Constant-Z Line	W100	100Ω Coax. Standard
F	Low-Pass Filter	M	Component Mount	W200	200Ω Coax. Standard
FR	Rejection Filter	MA	Adjustable Coupling Probe	WM	50Ω Termination
G	Fixed Attenuator	MB	Coupling Probe	WN	Short-Circuit Termination
GA	Adjustable Attenuator	T	Tee	WO	Open-Circuit Termination
JR	Rotary Joint	UB	Balun	X	Insertion Unit
K	Coupling Capacitor	UB-P2	200Ω Terminal Unit	XL	Series Inductor
L	Air Line			Y	Cliplock
LA	Adjustable Line			Z	Stand

The above is a partial listing. For complete list and specifications, refer to the General Radio Catalog.

GENERAL RADIO COMPANY

WEST CONCORD, MASSACHUSETTS

EMerson 9-4400 **CLearwater 9-8900**

DISTRICT OFFICES

NEW YORK

Broad Ave. at Linden, Ridgefield, N. J.
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Telephone VIllage 8-9400

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General Radio Company
Service Department
1000 N. Seward St., Los Angeles 38, Calif.
Telephone HOllywood 9-6201

CANADA

Bayly Engineering, Ltd.
First Street, Ajax, Ontario
Telephone Toronto EMpire 2-3741

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